CP400 Series Commercial/Industrial Pressure Loaded Pressure Reducing Regulators

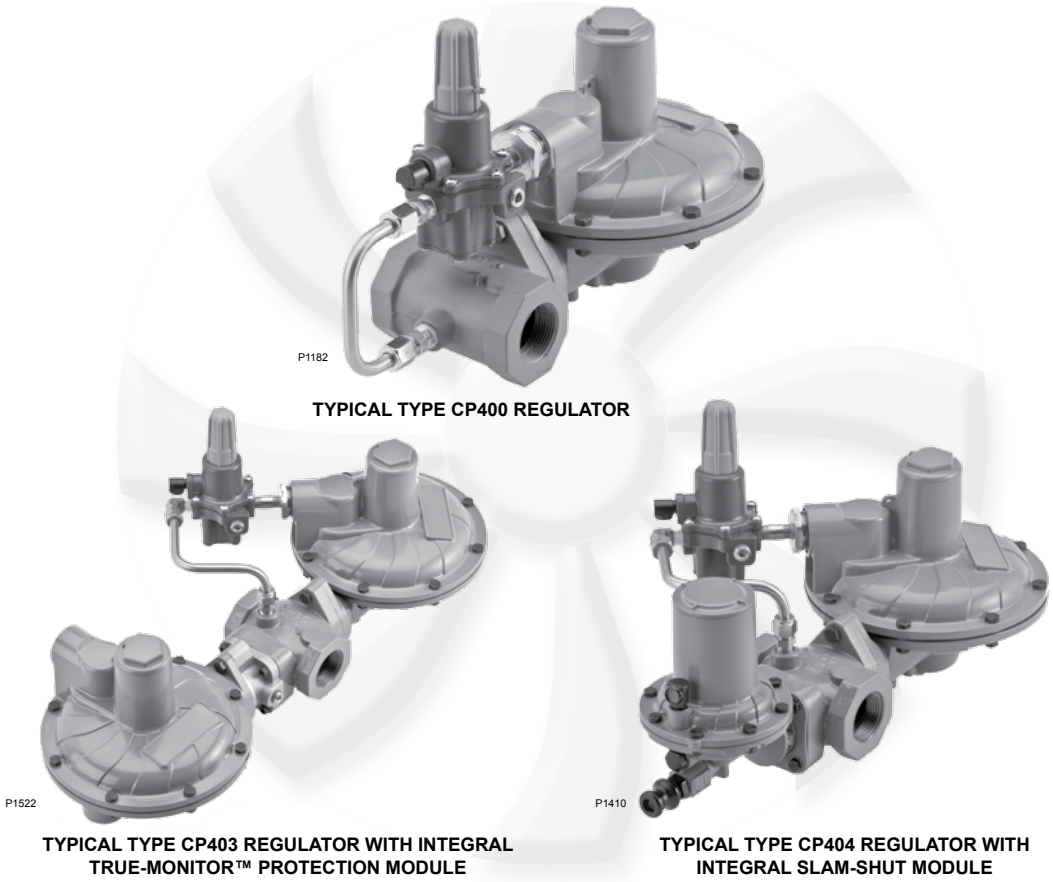

P1182
TYPICAL TYPE CP400 REGULATOR
P1522
TYPICAL TYPE CP403 REGULATOR WITH INTEGRAL TRUE-MONITOR™ PROTECTION MODULE
P1410
TYPICAL TYPE CP404 REGULATOR WITH INTEGRAL SLAM-SHUT MODULE

Figure 1. *CP400 Series Pressure Loaded Pressure Reducing Regulator*

Table of Contents

Introduction 1
Specifications 3
Principle of Operation 6
Installation and Overpressure Protection 8
Startup 11
Adjustment 12
Shutdown 13
Maintenance and Inspection 13
Parts Ordering 14
Parts List 14

Introduction

Scope of the Manual

This manual provides instructions for the installation, maintenance and parts ordering information for the CP400 Series pressure loaded regulators. Refer to the Type TM600 Instruction Manual for additional information regarding the operation of the CP400 Series with the Integral True-Monitor module. Refer to the Type VSX4 Instruction Manual for additional information regarding the operation of the CP400 Series with the slam-shut module.

D103122X012

Table 1. *Available Configurations*

TYPE NUMBER							OPTIONS
C	P	4	0				
							OVERPRESSURE PROTECTION MODULE
				0			Without Overpressure Protection Module
				3			With Integral Monitor Module(1)
				4			With Slam-shut Module(2)
							PRESSURE REGISTRATION
					E		External Registration
					I		Internal Registration
							RELIEF
						N	Non-Relief
						T	Token Internal Relief

Example: Type number CP404IT: CP400 Series regulator construction with Type VSX4 Slam-shut module, Internal pressure registration and Token relief.

1. Refer to Instruction Manual D103126X012 for information regarding the Integral Monitor Module.
2. Refer to Instruction Manual D103127X012 for information regarding the Type VSX4 Slam-shut module.

WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher® regulators must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Regulator Technologies) instructions.

If a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Call a gas service person to service the unit. Only a qualified person must install or service the regulator.

Description

The CP400 Series regulators are pressure-loaded regulators intended for general pressure reduction for commercial and industrial applications using pressure factor measurement, also referred to as fixed factor billing.

Overpressure protection options include the Type CP403 which offers True-Monitor™ Protection provided by an Integral Monitor Module installed on the inlet side of the valve body. This Integral Monitor assumes control of the downstream system pressure should the primary regulator no longer regulate. Another Overpressure protection option is provided by the Type CP404, which offers an integral slam-shut module installed on the inlet side of the valve body that shuts off the flow of gas to the downstream system in the event of outlet pressure rising above or falling below the predefined levels.

Optional token relief is available, which acts as a low capacity internal relief valve to relieve minor overpressure situations due to nicks or other minor damage to the orifice or disk, or due to thermal expansion of the downstream system. The Token relief is located in the Type 67CPR pressure loading regulator.

Internal and external outlet pressure registration is available. Constructions with external registration require an external control line/sense line.

Specifications

The Specifications section lists the specifications for the regulators. The following information is stamped on the regulator at the factory: Type, date of manufacture, spring range, orifice size, maximum inlet pressure, maximum operating outlet pressure and outlet pressure which may damage parts.

Available Configurations
See Table 1

Body Sizes, End Connections Styles and Pressure Rating(1)
See Table 4

Maximum Operating Inlet Pressure(1)
See Table 2

Maximum Outlet Pressures(1)
See Table 3

Outlet Pressure Ranges
See Table 5

Orifice Sizes
See Table 2

Flow and IEC Sizing Coefficients
See Table 2

Temperature Capabilities(1)(2)
-20 to 150°F / -29 to 66°C

Control Line Connection
3/4 NPT

Pressure Registration
Types CP400IT, CP400IN, CP403IT, CP403IN, CP404IN and CP404IT: Internal
Types CP400ET, CP400EN, CP403ET, CP403EN, CP404EN and CP404ET: External

Optional Internal Token Relief Performance (Located in Type 67CPR Pressure Loading Regulator)
Token relief is a low capacity relief intended to relieve overpressure occurrences due to minor seat leakage or thermal expansion only; other overpressure protection must be provided if inlet pressure can exceed the maximum pressure rating of downstream equipment or maximum outlet pressure rating of the regulator.

Token Relief Start-to-Discharge
See Table 6

Factory Setpoint Inlet Pressures for Various Orifice Sizes
3/16-inch / 4.8 mm: 60 psig / 4.1 bar
1/4-inch / 6.4 mm: 40 psig / 2.8 bar
3/8-inch / 9.5 mm: 25 psig / 1.7 bar
1/2-inch / 13 mm: 25 psig / 1.7 bar
5/8-inch / 16 mm: 15 psig / 1.0 bar
3/4-inch / 19 mm: 10 psig / 0.69 bar

Option
1/4 NPT Type P593-1 Aluminum Body Cellulose Filter

Approximate Weights
With threaded body
Type CP400: 11 pounds / 5.0 kg
Type CP403: 20.5 pounds / 9.3 kg
Type CP404: 13.2 pounds / 6.0 kg
Add 8.6 pounds / 3.9 kg to weights listed with flanged body

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. Product has passed Regulator Technologies testing for lockup, relief start-to-discharge and reseal down to -40 degrees.

Table 2. *Inlet Pressure Ratings and Flow and Sizing Coefficients*

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE		FLOW COEFFICIENTS (WIDE OPEN)		C_1	IEC SIZING COEFFICIENTS		
Inch	mm	psig	bar	C_g	C_v		X_T	F_D	F_L
3/16	4.8	125	8.6	27	0.97	27.7	0.50	0.91	0.89
1/4	6.4	125	8.6	50	1.77	28.2	0.50	0.92	
3/8	9.5	80	5.5	113	3.72	30.4	0.58	0.89	
1/2	13	60	4.1	182	5.61	32.4	0.66	0.82	
5/8	16	50	3.4	284	7.26	39.1	0.97	0.74	
3/4	19	40	2.8	356	9.83	36.2	0.83	0.72	

Table 3. *Maximum Outlet Pressures*

TYPE	EMERGENCY OUTLET PRESSURE (CASING)	MAXIMUM OUTLET PRESSURE TO AVOID INTERNAL PARTS DAMAGE	MAXIMUM OPERATING OUTLET PRESSURE
CP400 and CP404	25 psig / 1.7 bar	25 psig / 1.7 bar	20 psig / 1.4 bar
CP403	25 psig / 1.7 bar	5 psi / 0.34 bar over setpoint	7.5 psig / 0.52 bar

Table 4. *Body Sizes, Material, End Connections and Pressure Ratings*

TYPE	BODY MATERIAL	BODY SIZE	END CONNECTION	FACE-TO-FACE DIMENSION		PRESSURE RATING	
				Inch	mm	psig	bar
CP400	Gray Cast Iron	1-1/4	NPT	4.5	114	175	12.1
		1-1/2					
		1-1/4 x 1-1/2					
		2		5	127		
		NPS 2 / DN 50	CL125 FF	10	254		
CP400, CP403 and CP404	Ductile Iron	1-1/4	NPT	4.5	114	290	20.0
		1-1/2					
		2		5	127		
		1-1/4	Rp	4.5	114		
		1-1/2					
		2		5	127		
		NPS 2 / DN 50	CL125 FF / CL150 FF	10	254		
		NPS 2 / DN 50	PN 10/16			232	16.0
	Steel	1-1/4	NPT	4.5	114	290	20.0
		1-1/2					
		1-1/4	Rp	7.5	191		
		1-1/2		10	254		

Table 5. *Outlet Pressure Ranges*

TYPE	OUTLET PRESSURE RANGE[1]		SPRING NUMBER	PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	bar				Inch	mm	Inch	mm
CP400, CP403[2] and CP404	1 to 2	69 mbar to 0.14	1	GE30199X012	Yellow Stripe	0.085	2.16	1.47	37.3
	2 to 5	0.14 to 0.34	2	GE27213X012	Orange Stripe	0.096	2.44	1.47	37.3
CP400 and CP404	5 to 10	0.34 to 0.69	3	GE39890X012	Black Stripe	0.114	2.90	1.47	37.3
	10 to 20	0.69 to 1.4	4	GE30200X012	Purple Stripe	0.137	3.48	1.43	36.3

1. Outlet pressure range is controlled by 67CP Series pressure loading regulator spring.
2. Maximum operating outlet pressure for the integral True-Monitor™ installed on Type CP403 is 7.5 psig / 0.52 bar.

Table 6. *Token Relief Valve Start-to-Discharge Pressure Above Setpoint*

SPRING RANGE[1]		SPRING COLOR	SPRING PART NUMBER	START-TO-DISCHARGE PRESSURE RANGE ABOVE SETPOINT	
psig	bar			psig	mbar
1 to 2	69 mbar to 0.14	Yellow Stripe	GE30199X012	1 to 3.5	69 to 241
2 to 5	0.14 to 0.34	Orange Stripe	GE27213X012	1.75 to 5.5	121 to 379
5 to 10	0.34 to 0.69	Black Stripe	GE39890X012	2.5 to 6.75	172 to 465

1. Outlet pressure range is controlled by 67CP Series pressure loading regulator spring. Only the 1 to 2, 2 to 5 and 5 to 10 psig / 69 mbar to 0.14, 0.14 to 0.34 and 0.34 to 0.69 bar spring ranges are available with token relief.

Table 7. *CP403 Series Spring Ranges (Without Token Relief)*

TYPE	PRIMARY REGULATOR					INTEGRAL MONITOR				
	Typical Setpoint		Spring Range		Spring Color	Minimum Setpoint		Spring Range		Spring Color
	psig	bar	psig	bar		psig	bar	psig	bar	
CP403IN and CP403EN	1	69 mbar	1 to 2	69 mbar to 0.14	Yellow Stripe	2	0.14	1.4 to 2.9	0.10 to 0.20	Black
	2	0.14				3	0.21	2.6 to 3.7	0.18 to 0.26	Purple
	3	0.21	2 to 5	0.14 to 0.34	Orange Stripe	5	0.34	3.6 to 6	0.25 to 0.41	Dark Blue
	4	0.28				6	0.41	5.1 to 7.5	0.35 to 0.52	Red
	5	0.34				7	0.48			

Table 8. *CP403 Series Spring Ranges (With Token Relief)*

TYPE	PRIMARY REGULATOR					INTEGRAL MONITOR				
	Typical Setpoint		Spring Range		Spring Color	Minimum Setpoint		Spring Range		Spring Color
	psig	bar	psig	bar		psig	bar	psig	bar	
CP403IT and CP403ET	1	69 mbar	1 to 2	69 mbar to 0.14	Yellow Stripe	5	0.34	3.6 to 6	0.25 to 0.41	Dark Blue
	2	0.14				5.5	0.38	5.1 to 7.5	0.35 to 0.52	Red

Table 9. *CP404 Series Regulator and Slam-shut Spring Ranges (Overpressure Shutoff (OPSO) Only)*

TYPE	REGULATOR				SLAM SHUT				
	Typical Setpoint		Spring Range[1]		Overpressure Shutoff (OPSO)				
	psig	bar	psig	bar	Typical Setpoint		Spring Range		Spring Part Number
					psig	bar	psig	bar	
CP404IN, CP404IT, CP404EN and CP404ET	1	69 mbar	1 to 2	69 mbar to 0.14	5	0.34	2 to 7.3	0.14 to 0.50	GF02172X012
	2	0.14			5.5	0.38			
	3	0.21	2 to 5	0.14 to 0.34	8.5	0.59	3.2 to 11	0.22 to 0.76	GF02173X012
	4	0.28			9.5	0.66			
	5	0.34			10.5	0.72	5.8 to 21	0.40 to 1.4	GF04353X012
	6	0.41	5 to 10	0.34 to 0.69	11.5	0.79			
	7	0.48			14	0.97			
	10	0.69			17	1.2			
CP404IN and CP404EN	12	0.83	10 to 20	0.69 to 1.4	18	1.2			
	15	1.0			20	1.4			
	20	1.4			25	1.7	13.1 to 43.5	0.90 to 3.0	GF02173X012
1. Token Relief is not available with the 10 to 20 psig / 0.69 to 1.4 bar spring range.									

Table 10. *CP404 Series Regulator and Slam-shut Spring Ranges Overpressure and Underpressure Shutoff (OPSO and UPSO)*

TYPE	REGULATOR				SLAM SHUT									
	Typical Setpoint		Spring Range[1]		Overpressure Shutoff (OPSO)					Underpressure Shutoff (UPSO)				
	psig	bar	psig	bar	Typical Setpoint		Spring Range		Spring Part Number	Typical Setpoint		Spring Range		Spring Part Number
					psig	bar	psig	bar		psig	bar	psig	bar	
CP404IN, CP404IT, CP404EN and CP404ET	1	69 mbar	1 to 2	69 mbar to 0.14	5	0.34	2.2 to 5.5	0.15 to 0.38	GF02170X012	0.5	0.03	0.36 to 2.3	0.03 to 0.16	T14170T0012
	2	0.14			5.5	0.38				1	69 mbar			
	3	0.21	2 to 5	0.14 to 0.34	8.5	0.59				2	0.14	1.5 to 7.3	0.10 to 0.50	FA142869X12
	4	0.28			9.5	0.66	5.8 to 16	0.40 to 1.1	GF02172X012	3	0.21			
	5	0.34			10.5	0.72				4	0.28			
	6	0.41	5 to 10	0.34 to 0.69	11.5	0.79				4.5	0.31			
	7	0.48			14	0.97				5.5	0.38			
	10	0.69			17	1.2	11.6 to 23.2	0.80 to 1.6	GF02173X012	8	0.55	1.5 to 10.9	0.10 to 0.75	T14171T0012
CP404IN and CP404EN	12	0.83	10 to 20	0.69 to 1.4	18	1.2				9	0.62			
	15	1.0			20	1.4				10	0.69			
	20	1.4			25	1.7	16 to 29	1.1 to 2.0	GF02171X012	14	0.96	7.3 to 29	0.50 to 2.0	FA142869X12
1. Token Relief is not available with the 10 to 20 psig / 0.69 to 1.4 bar spring range.														

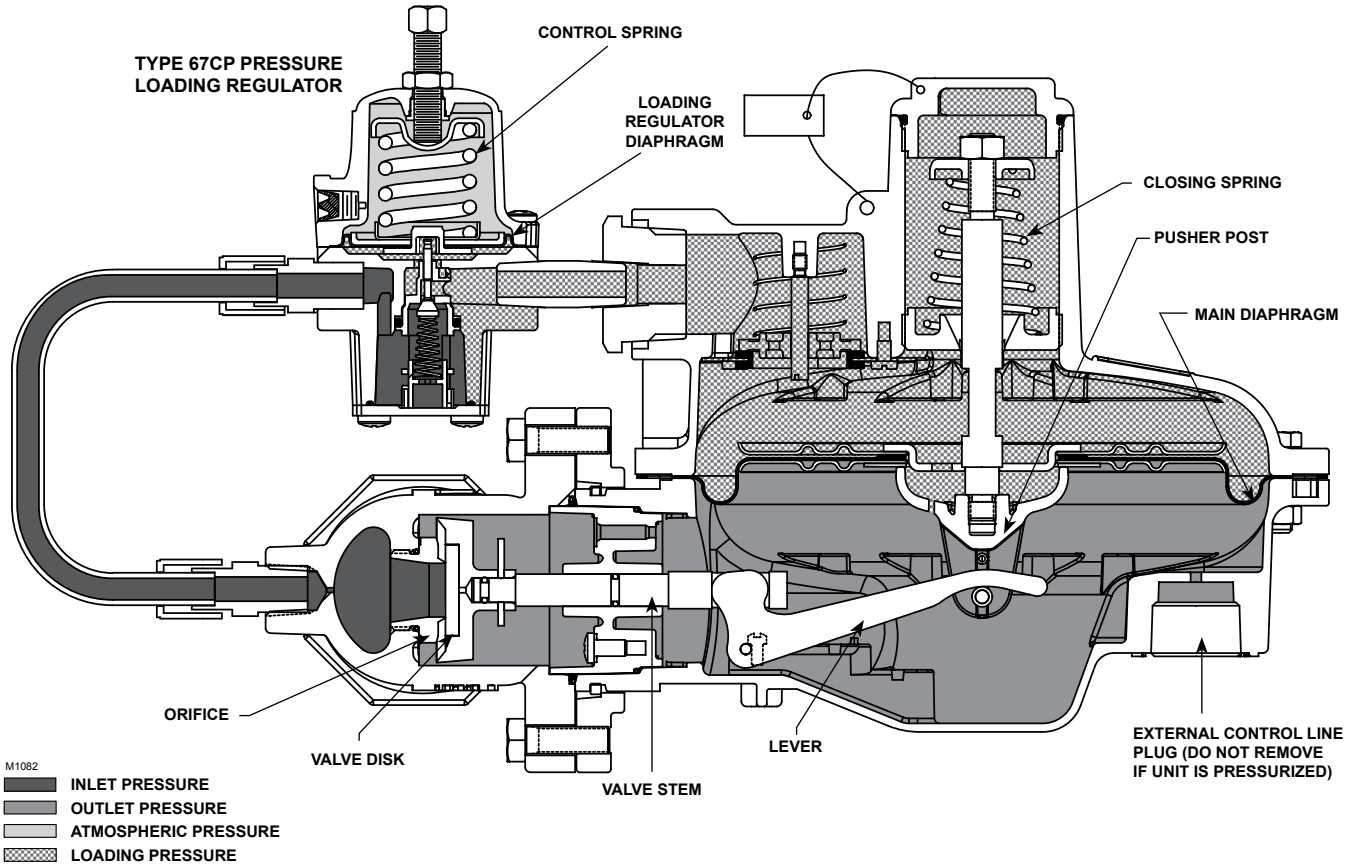


Figure 2. *Type CP400IN with Internal Pressure Registration Operational Schematic*

Principle of Operation

Type CP400 Base Regulator Operation

The CP400 Series has spring-to-close construction. The CP400 Series uses a 67CP Series loading pressure regulator to supply loading pressure to the top of the main diaphragm. Since the loading pressure regulator controls the main regulator, adjustment to the downstream pressure is made to the loading pressure regulator. The load pressure supplied by the loading regulator is constant and equal to the desired downstream pressure plus the pressure required to overcome the light closing spring.

Increasing Downstream Demand

As downstream demand increases, the outlet pressure registering on the underside of the main diaphragm decreases and the constant loading pressure above the main diaphragm forces the diaphragm downward. This downward diaphragm motion is transferred through the lever causing the main disk to move away from the orifice seating surface to supply additional flow downstream to the required demand.

Decreasing Downstream Demand

As downstream demand decreases the outlet pressure registering on the underside of the main diaphragm increases forcing the main diaphragm upward. This upward motion is transferred through the lever causing the main disk to move toward the orifice seating surface to reduce flow to meet the required demand.

Zero Downstream Demand (Lockup)

As downstream demand decreases further, the outlet pressure registering under the main diaphragm together with the closing spring act to close the main disk against the orifice seating surface. At this point the loading regulator will continue to supply a small amount of gas downstream that is equal to the capacity of the bleed restriction in the diaphragm assembly. As downstream demand decreases to zero flow outlet pressure rises to meet the lock-up pressure of the loading regulator. This causes the loading regulator to lock up to stop all flow downstream.

Type numbers with a “T”, for example, Type CP400IT, provide a token or low capacity relief. The Token relief provides relief from minor overpressure caused by nicks or dents on the orifice or by thermal expansion

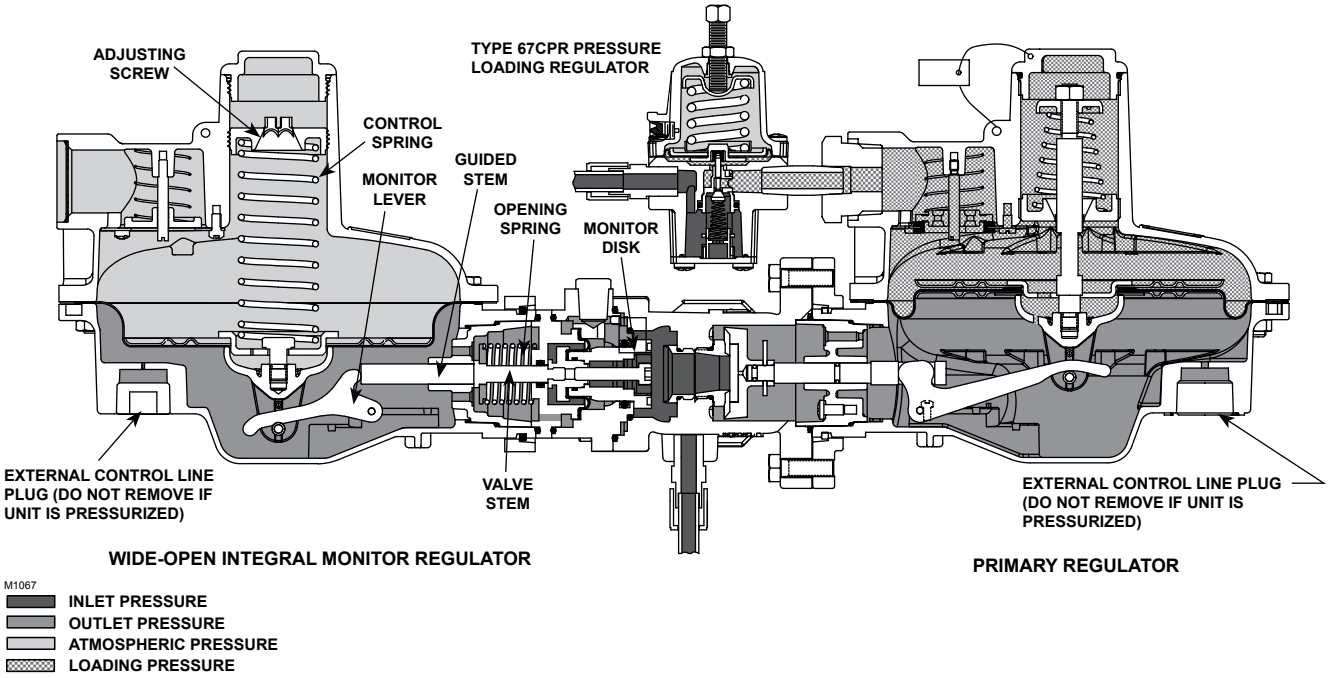


Figure 3. *Type CP403IT Pressure Loaded Regulator with True-Monitor™ and Internal Pressure Registration Operational Schematic*

of gas in the downstream line. Token relief also provides a token or signal, in the form of odor, that an overpressure situation is occurring.

Type CP403 Integral Monitor Operation

Type CP403 combines the operation of a conventional two-regulator wide-open monitor set into one body, see Figure 3. The Integral True-Monitor is installed on the inlet side of the body and serves to throttle flow and maintain an acceptable downstream pressure in the case where the Primary regulator fails to regulate downstream pressure. During normal operation, the Integral Monitor is in a wide-open state as its setpoint is set higher than the primary regulator. See Tables 7 and 8 for guidance regarding the setpoints of the regulator and associated Integral Monitor sets. If the downstream pressure should rise to the setpoint of the internal monitor due to loss of pressure control by the primary regulator, the Integral Monitor will assume control and regulate the flow to the downstream system. See the Type TM600 Instruction Manual for additional details of operation.

If a Token relief is present, the token relief will relieve a small amount of gas to the atmosphere as an indication that the Integral monitor is controlling the downstream pressure.

Type CP404 Slam-shut Operation

The Type VSX4 slam-shut module on the Type CP404 regulator is a fast acting shut-off device that provides overpressure (OPSO) or over and underpressure (OPSO/UPSO) protection by completely shutting off the flow of gas to the downstream system. See Tables 9 and 10 for guidance regarding the typical setpoints of the regulator and associated OPSO and UPSO settings. The Type VSX4's actions are independent of the Type CP404 regulator and of variations to the inlet pressure. The Type VSX4 provides the option of internal or external downstream pressure registration. External registration requires a downstream sensing line.

The Type VSX4 shut-off disk is normally in the open (reset) position, see Figure 4. If the downstream pressure below the slam-shut diaphragm increases (or decreases) until it reaches the slam-shut setpoint, this diaphragm moves upward (or downward) to release the trip mechanism which allows the spring force on the stem to push the disk against the seat, shutting off all gas flow. Refer to the Type VSX4 Instruction Manual to reset the slam-shut device.

In order for the Underpressure Shutoff (UPSO) of any slam-shut to be triggered, the downstream pipe pressure must drop below the UPSO setpoint. In the case of a downstream line break, numerous factors can prevent the downstream pipe pressure from decreasing below the slam-shut UPSO setpoint. These factors include the distance of pipe to the break, the diameter of the pipe, size of the break and the number of restrictions, such as valves, elbows and bends, downstream of the regulator and/or slam-shut device. Due to these factors additional protections should be installed to stop flow in the event of a line break.

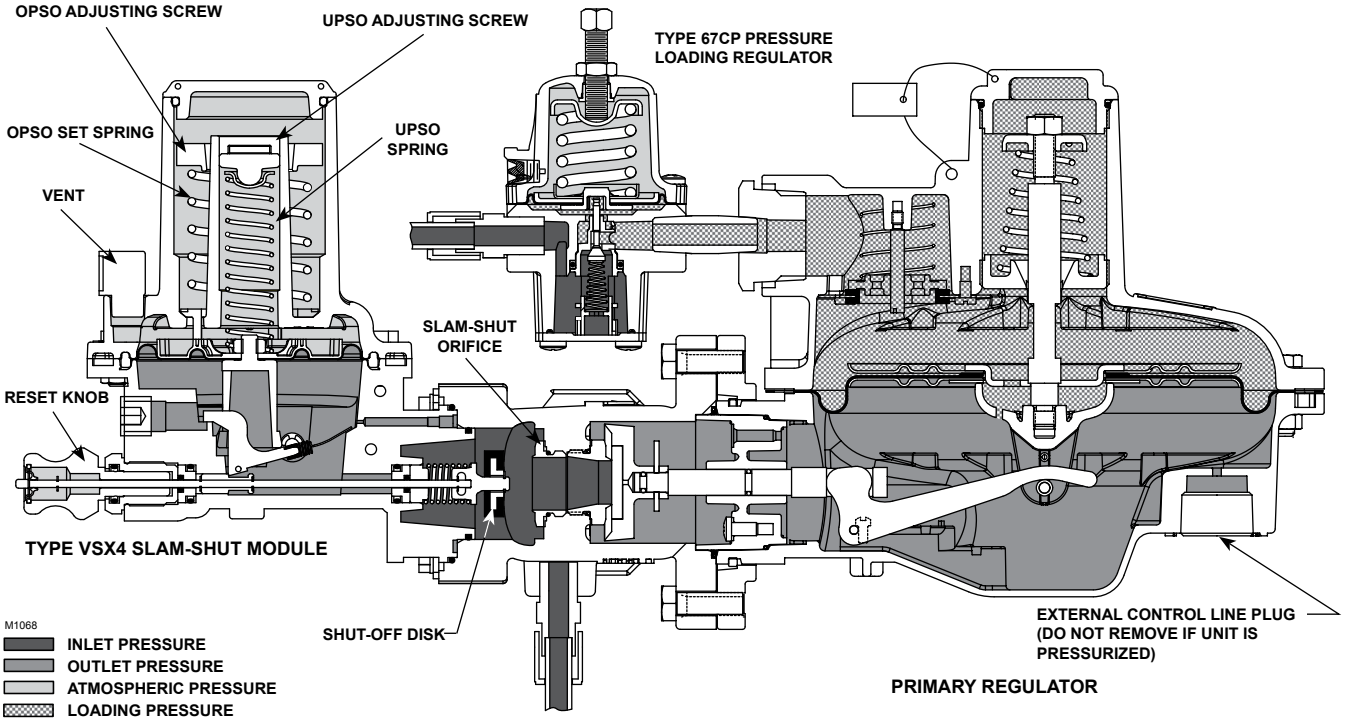


Figure 4. *Type CP404IN Pressure Loaded Regulator with Slam-shut Module and Internal Pressure Registration Operational Schematic*

Installation and Overpressure Protection

WARNING

Personal injury or system damage may result if this regulator is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or regulator nameplate.

Regulator installations should be adequately protected from physical damage.

All vents should be kept open to permit free flow of gas to the atmosphere. Protect openings against entrance of rain, snow, insects or any other foreign material that may plug the vent or vent line. On outdoor installations, point the spring case vent downward to allow condensate to drain (see Figures 5 through 7).

This minimizes the possibility of freezing and of water or other foreign materials entering the vent and interfering with proper operation.

For the Type CP403 with the Integral Monitor or the Type CP404 with Slam shut, point the vents of both the Primary Regulator and Integral Monitor or Slam shut downward to allow condensate to drain. From the factory, the Integral Monitor or Slam shut will always point in the same direction as that of the Primary Regulator.

Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In these cases, the vent should be piped away from the regulator to the outdoors.

CAUTION

The CP400 Series regulators have an outlet pressure rating lower than their inlet pressure rating. If actual inlet pressure can exceed the outlet pressure rating, outlet overpressure protection is necessary. However, overpressuring any portion of the regulators beyond the limits in Specifications section may cause leakage, damage to regulator parts or personal injury due to bursting of pressure-containing parts.

Some type of external overpressure protection should be provided to the CP400 Series if inlet pressure will be

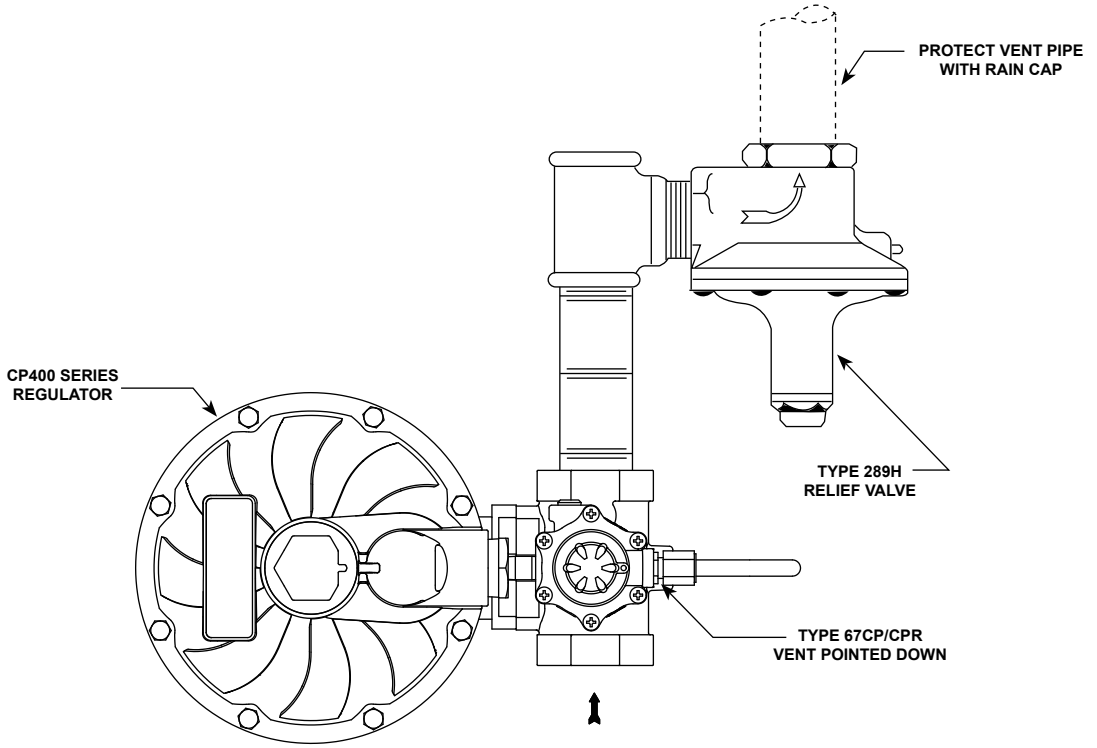


Figure 5. *CP400 Series Regulator Installed the Vent Pointed Downward and with Type 289H Relief Valve for High Capacity Relief*

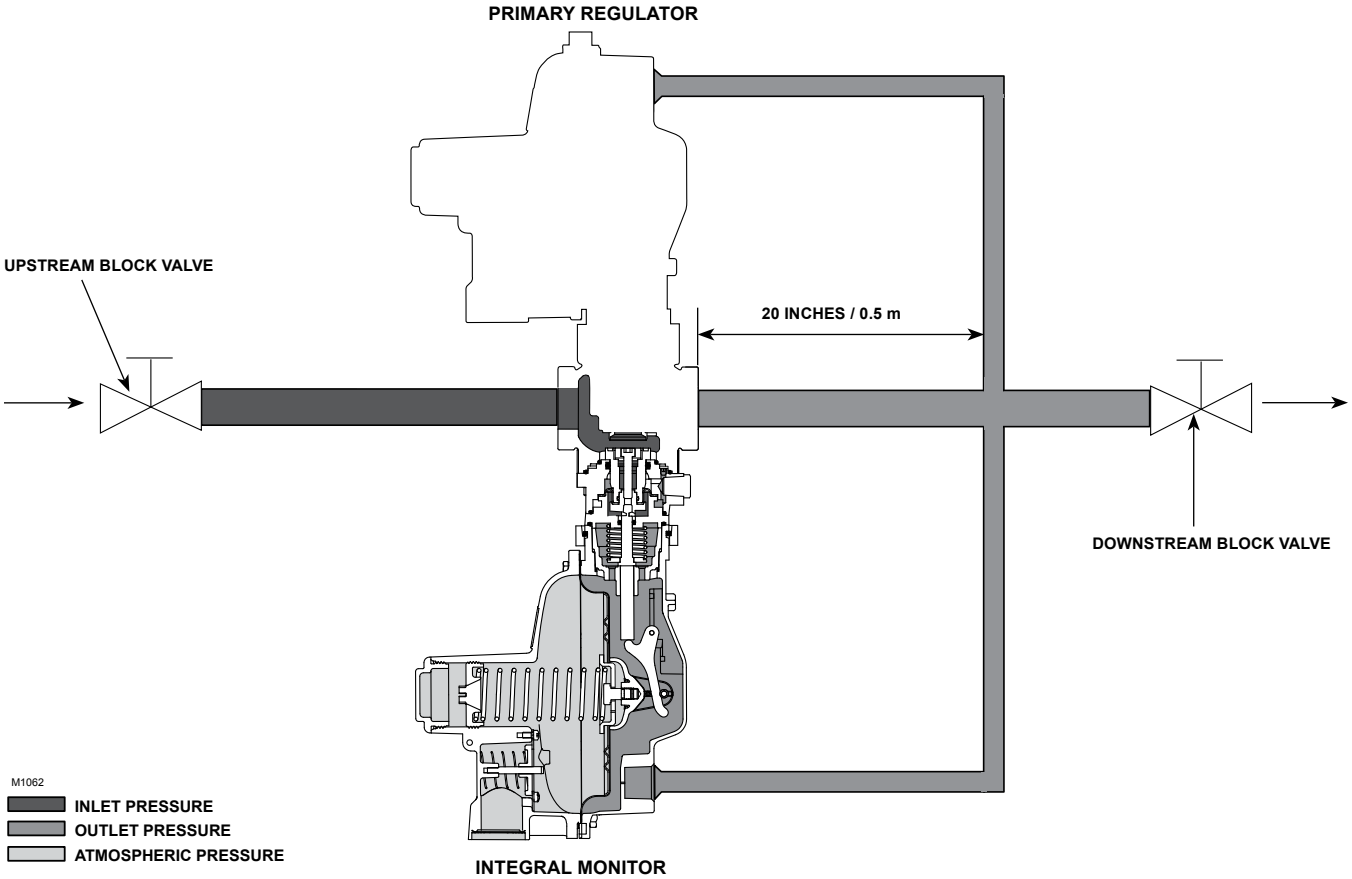


Figure 6. *Typical CP403 Downstream Control Line Connection (Pressure Loading Regulator Not Shown)*

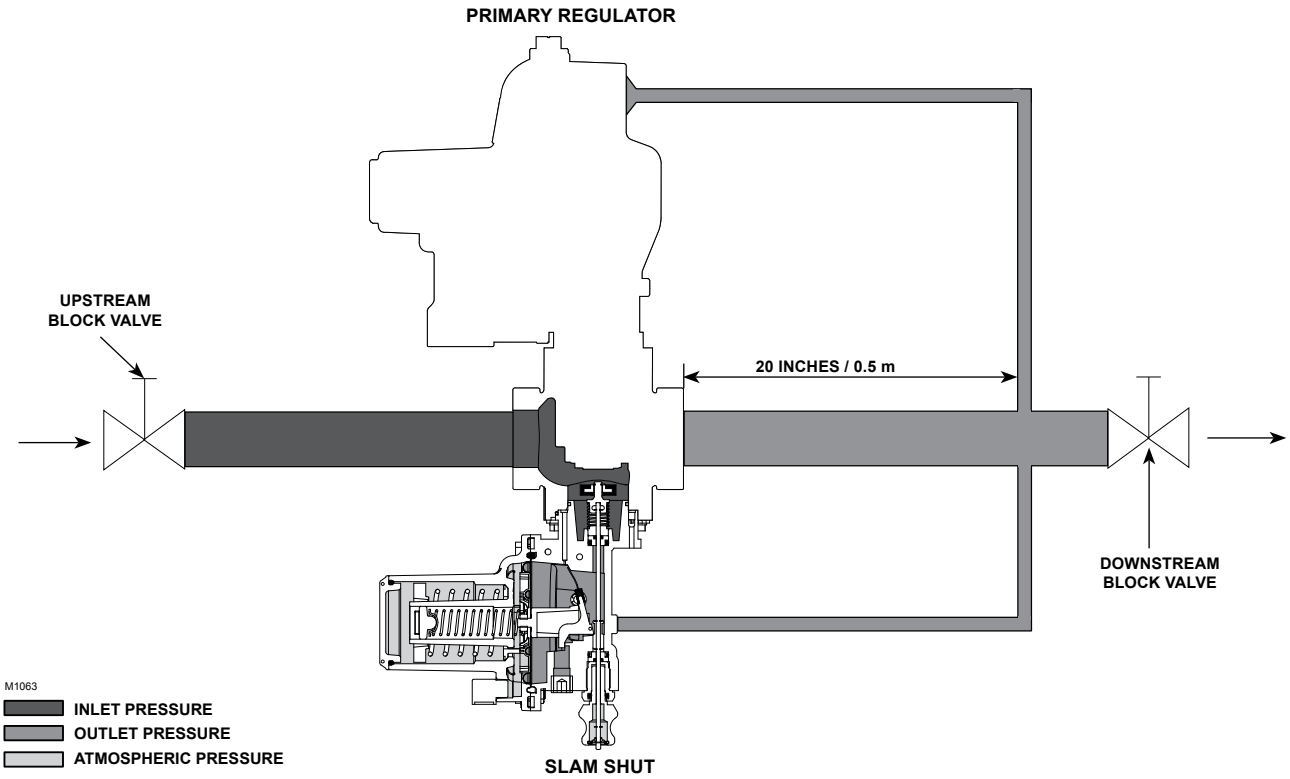


Figure 7. *Typical CP404 Downstream Control Line Connection (Pressure Loading Regulator Not Shown)*

high enough to damage downstream equipment. Common methods of external overpressure protection include relief valves, monitoring regulators, shut-off devices and series regulation.

If the regulator is exposed to an overpressure condition, it should be inspected for any damage that may have occurred. Regulator operation below the limits specified in the Specifications section does not preclude the possibility of damage from external sources or from debris in the pipeline.

General Installation Instructions

Before installing the regulator,

- Check for damage, which might have occurred during shipment.
- Check for and remove any dirt or foreign material, which may have accumulated in the regulator body.
- Blow out any debris, dirt or copper sulfate in the copper tubing and the pipeline.
- Apply pipe compound to the male threads of the pipe before installing the regulator.
- Make sure gas flow through the regulator is in the same direction as the arrow on the body. “Inlet” and “Outlet” connections are clearly marked.

Installation Location

- The installed regulator should be adequately protected from vehicular traffic and damage from other external sources.
- **Install the regulator with the vent pointed vertically down, see Figures 5 through 7.** If the vent cannot be installed in a vertically down position, the regulator must be installed under a separate protective cover. Installing the regulator with the vent down allows condensation to drain, minimizes the entry of water or other debris from entering the vent and minimizes vent blockage from freezing precipitation.
- **Do not install the Type CP400, CP403 or CP404 in a location where there can be excessive water accumulation or ice formation,** such as directly beneath a downspout, gutter or roof line of building. Even a protective hood may not provide adequate protection in these instances.
- Install the Regulator so that any gas discharge through the vent or vent assembly is over 3 feet / 0.9 m away from any building opening.

Regulators Subjected to Heavy Snow Conditions

Some installations, such as in areas with heavy snowfall, may require a hood or enclosure to protect the regulator from snow load and vent freeze over.

Downstream Control Line Installation

A CP400 Series regulator with an EN or ET in the type number has a blocked throat, an O-ring stem seal and a 3/4 NPT control line tapping in the lower diaphragm casing. A regulator with a downstream control line is used for monitoring installations or other applications where there is other equipment installed between the regulator and the pressure control point.

For CP400 Series regulator with an EN or ET in the type number, connect downstream control line tubing to the lower casing, and run the tubing approximately 20 inches / 0.5 m downstream. For best results, the outer diameter of the control line tubing should be 3/8 inch / 9.5 mm or larger.

Downstream Control Line Installation with Integral Monitor

Refer to Figure 6. When installing the Types CP403ET and CP403EN regulators, connect downstream control line tubing to the lower casing of the Primary Regulator, and run the tubing approximately 20 inches / 0.5 m downstream. Connect a second, separate downstream control line tubing to the lower casing of the Integral Monitor, and run the tubing approximately 20 inches / 0.5 m downstream. For best results, the outer diameter of the control line tubing for both the Primary Regulator and the Integral Monitor should be 3/8 inch / 9.5 mm or larger.

Downstream Control Line Installation with Slam shut

Refer to Figure 7. When installing the Types CP404ET and CP404EN regulators, connect downstream control line tubing to the lower casing of the Regulator, and run the tubing approximately 20 inches / 0.5 m downstream. Connect a second, separate downstream control line tubing to the lower casing of the slam shut, and run the tubing approximately 20 inches / 0.5 m downstream. For best results, the outer diameter of the control line tubing for the Regulator should be 3/8 inch / 9.5 mm or larger. The outer diameter of the control line tubing for the slam shut should be 1/4 inch / 6.4 mm or larger.

Installation with External Overpressure Protection

If the regulator is used in conjunction with a Type 289H relief valve, it should be installed as shown in Figure 5. The outside end of the vent line should be protected with a rainproof assembly. The Type 289H is typically set 10 inches w.c. / 25 mbar higher than the outlet pressure setting of the regulator, up to 30 inches w.c. / 75 mbar outlet pressure. For pressure greater than this, set the Type 289H 0.75 psi / 0.05 bar higher than the outlet pressure setting of the regulator.

Vent Line Installation

The CP400 Series regulators have a 1/4 NPT screened vent opening in the spring case of the loading pressure regulator spring case. If necessary to vent escaping gas away from the regulator, install a remote vent line in the spring case tapping. Vent piping should be as short and direct as possible with a minimum number of bends and elbows. The remote vent line should have the largest practical diameter.

For Types with optional Token relief, this optional low capacity relief is located in the spring case of the Type 67CPR Loading Pressure Regulator. If necessary to vent escaping gas away, install a remote vent line in the spring case tapping of the Type 67CPR Loading Pressure Regulator as described above.

Periodically check all vent openings to be sure that they are not plugged.

CP400 Series Outlet pressure ranges are shown in Table 5. Outlet pressure greater than 5 psi / 0.34 bar above setpoint may damage internal parts such as the diaphragm head and valve disk. **The maximum emergency (casing) outlet pressure is 25 psig / 1.7 bar.**

Startup

CAUTION

Pressure gauges should always be used to monitor downstream pressure during Startup.

Note

For types that include the Integral Monitor module, refer to the Instruction Manual for Type TM600 Integral Monitor for adjustment and maintenance of the Integral Monitor. For the types that include the slam-shut module, refer to the

instruction manual for Type VSX4 Slam shut for adjustment and maintenance of the slam shut.

The range of allowable pressure settings for the primary regulator is stamped on the nameplate. If the required setting is not within this range, substitute the correct spring (as shown in Table 5). If the spring is changed, change the nameplate to indicate the new pressure range.

A pressure gauge should always be used to monitor downstream pressure while adjustments are being made.

Adjustment

To increase the outlet pressure setting of the regulator, the adjusting screw of the loading regulator (key 18, Figure 15) must be turned clockwise. This requires loosening the locknut (key 19). To reduce the outlet pressure setting, turn the adjusting screw counterclockwise. Retighten the locknut. A pressure gauge should always be used to monitor downstream pressure while adjustments are being made.

CAUTION

Do not remove the locknut or adjust the spring to produce an outlet pressure setting outside the range of 1 to 20 psig / 69 mbar to 1.4 bar.

CP400 Series with Integral Monitor

When adjusting the primary regulator and Integral Monitor for operation, ensure that the pressure differences between the primary regulator and the Integral Monitor shown in Tables 7 and 8 are observed. For example, if the primary regulator setpoint is set at 8 inches w.c. / 20 mbar, then the Integral Monitor should be set at a minimum of 14 inches w.c. / 35 mbar or higher.

To test the Integral Monitor operation, the primary regulator setpoint must be adjusted above the Integral Monitor's setpoint to simulate a failure of the primary regulator. If the spring range of the primary regulator is sufficiently high, it can simply be adjusted above the Integral Monitor's setpoint by following the adjustment procedure for the primary regulator. Otherwise, a different spring with a setpoint higher than the Integral Monitor's setpoint must be installed to check the operation of the Integral Monitor.

CP400 Series with Slam shut

When adjusting the primary regulator and slam shut for operation, refer to Table 9 for the OPSO setpoints and Table 10 of OPSO and UPSO setpoints of the slam shut for the given regulator spring ranges.

WARNING

In the case of a downstream line break, numerous factors affect the capability to evacuate gas from the pipeline. These factors include the distance of pipe to the break, the diameter of the pipe, size of the break and the number of restrictions, such as valves, elbows and bends, downstream of the regulator and/ or slam-shut device. Due to these factors additional protections should be installed to stop flow in the event of a line break.

CAUTION

Equipment installed downstream the Type VSX slam-shut device can be damaged if the following procedure for resetting the Type VSX slam-shut device is not followed. This equipment includes the integral Type VSX/regulator configurations.

Step 1:

- To properly reset the Type VSX slam shut after it has been tripped to the closed position, a flat-head screwdriver must be inserted into the position shown in Figure 8 on the backside of the reset button (key 30, Figure 8).

Step 2:

- The screwdriver should be slowly rotated to gradually pull the reset button (key 30) away from the Type VSX device. This slow movement allows for a slow bleed of the pressure across the Type VSX slam-shut's disk and seat area. The operator should be able to hear the pressure bleeding through the system.

Step 3:

- When the pressure has equalized and the air bleeding sound has dissipated, the reset button (key 30) should be pulled completely away from the Type VSX slam-shut device by hand until the internal shut-off mechanism has been re-latched.

Step 4:

- Once the operator feels the click of the re-latch occurring, the reset button (key 30) should be pushed completely back into its original position.

Shutdown

Installation arrangements may vary, but in any installation it is important that the valves be opened or closed slowly and that the outlet pressure be vented before venting inlet pressure to prevent damage caused by reverse pressurization of the regulator. The steps below apply to the typical installation as indicated.

1. Open valves downstream of the regulator.
2. Slowly close the upstream block valve.
3. Pressure releases downstream.

Maintenance and Inspection

WARNING

To avoid personal injury or equipment damage, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure as described in "Shutdown".

Regulators that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Regulator Technologies should be used for repairing Fisher® regulators. Restart gas utilization equipment according to normal startup procedures.

Due to normal wear or damage that may occur from external sources, this regulator should be inspected and maintained periodically. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirements of local, state and federal rules and regulations.

Periodic inspection must be performed on the CP400 Series that include the Integral Monitor or slam-shut overpressure protection modules to ensure that they protect the downstream system in the event the primary regulator losses pressure control. This inspection must test that the Integral Monitor or slam-shut functions as intended. The frequency of this inspection must be at intervals not exceeding 15 months, but at least once each calendar year.

When maintenance is required on the slam-shut device, refer to the Type VSX4 Instruction Manual, part number D103127X012. When maintenance is required on the Integral True-Monitor™ device, refer to the Type TM600 Integral Monitor Instruction Manual, part number D103126X012.

To Replace Main Diaphragm

1. Disconnect the tubing connector (key 29, Figure 8) from the loading pressure regulator.
2. Remove closing cap (key 60, Figure 8) and unscrew the nut (key 47). Unthread the upper spring seat (key 42) using a flat head screwdriver. Remove the closing spring (key 38).
3. Unscrew and remove the cap screws (key 15) and nuts (key 16) and lift the spring case (key 1) with attached loading regulator off the lower casing (key 9) and the closing stem (key 44).

Note

When disassembling a CP400 Series regulator, lift the upper spring case (key 1) and the loading pressure regulator straight up in order to avoid hitting the stem (key 44).

4. Lift the diaphragm assembly (key 55) slightly so that the pusher post (key 51) can release the valve lever (key 10).
5. Hold the pusher post (key 51) fixed while unscrewing the closing stem (key 44) from the pusher post (key 51). Remove the diaphragm retainer (key 43) and diaphragm head (key 55). The diaphragm can now be removed.
6. Reassemble in the reverse order of the above procedure. Before tightening the cap screws (key 15) or closing stem (key 44) into the pusher post (key 51), place the loosely-assembled diaphragm assembly (key 55) into position in the lower casing (key 9), the arch or bow of the diaphragm should be towards the diaphragm head and lower casing (see Figure 8). Ensure that the pusher post (key 51) is hooked on the lever (key 10). Rotate the diaphragm (key 55) so that the diaphragm and lower casing (key 9) holes are aligned.

To Replace Valve Disk and Orifice

1. Remove the tubing connector (key 29, Figure 8) from the regulator body (key 70, Figure 8).
2. Remove the two cap screws (key 71) which hold the union ring (key 17) portion of the lower casing to the body.
3. The regulator can be removed from the body, exposing the disk (key 36) and the orifice (key 25).
4. Examine the seating surface of the disk. If it is nicked, cut or otherwise damaged, the disk should be unclipped and removed from the valve stem (key 11) and replaced.
5. Examine the seating edge of the orifice (key 25). If it is nicked or rough, it should be unscrewed from the body with a 1-1/16-inch / 27 mm socket wrench and replaced with a new orifice (key 25) and O-ring (key 27) to provide proper shutoff. Apply anti-seize lubricant to the male threads of the new orifice before reassembling. If a slam shut or monitor is installed on the backside of the body, refer to the applicable Instruction Manual for inspection and removal of the overpressure protection orifice (key 26) and O-ring (key 27).
6. Reassemble in reverse order of the above procedure. Care should be taken so that the O-ring (key 21) is not cut.

Types 67CP and 67CPR

Trim Maintenance

Key numbers are referenced in Figure 15.

1. Remove four bottom plate screws (key 3) from the bottom plate (key 39) and separate the bottom plate and O-ring (key 4) from the body (key 1).
2. Inspect the removed parts for damage and debris. Replace any damaged parts.
3. To remove the valve cartridge assembly, grasp the end of cartridge (key 10) and pull it straight out of body (key 1). Replace with new cartridge assembly. The cartridge assembly may be disassembled and parts may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve cartridge assembly.
4. Check O-ring (key 14) for wear and replace, if necessary. Apply lubricant to the O-ring and place in the body. Align cartridge key to keyway in body and insert. Reinstall the O-ring (key 4), secure the bottom plate (key 39) with screws (key 3) and torque to 15 to 30 inch-pounds / 1.9 to 3.9 N•m.

Regulator Reassembly

As indicated by the square callouts in Figures 8 to 15, it is recommended that a good quality pipe thread sealant be applied to pressure connections and fittings and a good quality lubricant be applied to all O-rings except when replacing key 19. Also apply an anti-seize compound to the adjusting screw threads and other areas as needed. See Figures 8 through 14 for details.

Parts Ordering

The type number, orifice (port) size and date of manufacture are stamped on the nameplate. Always provide this information in any correspondence with your local Sales Office regarding replacement parts or technical assistance. If construction changes are made in the field, be sure that the nameplates are also changed to reflect the most recent construction.

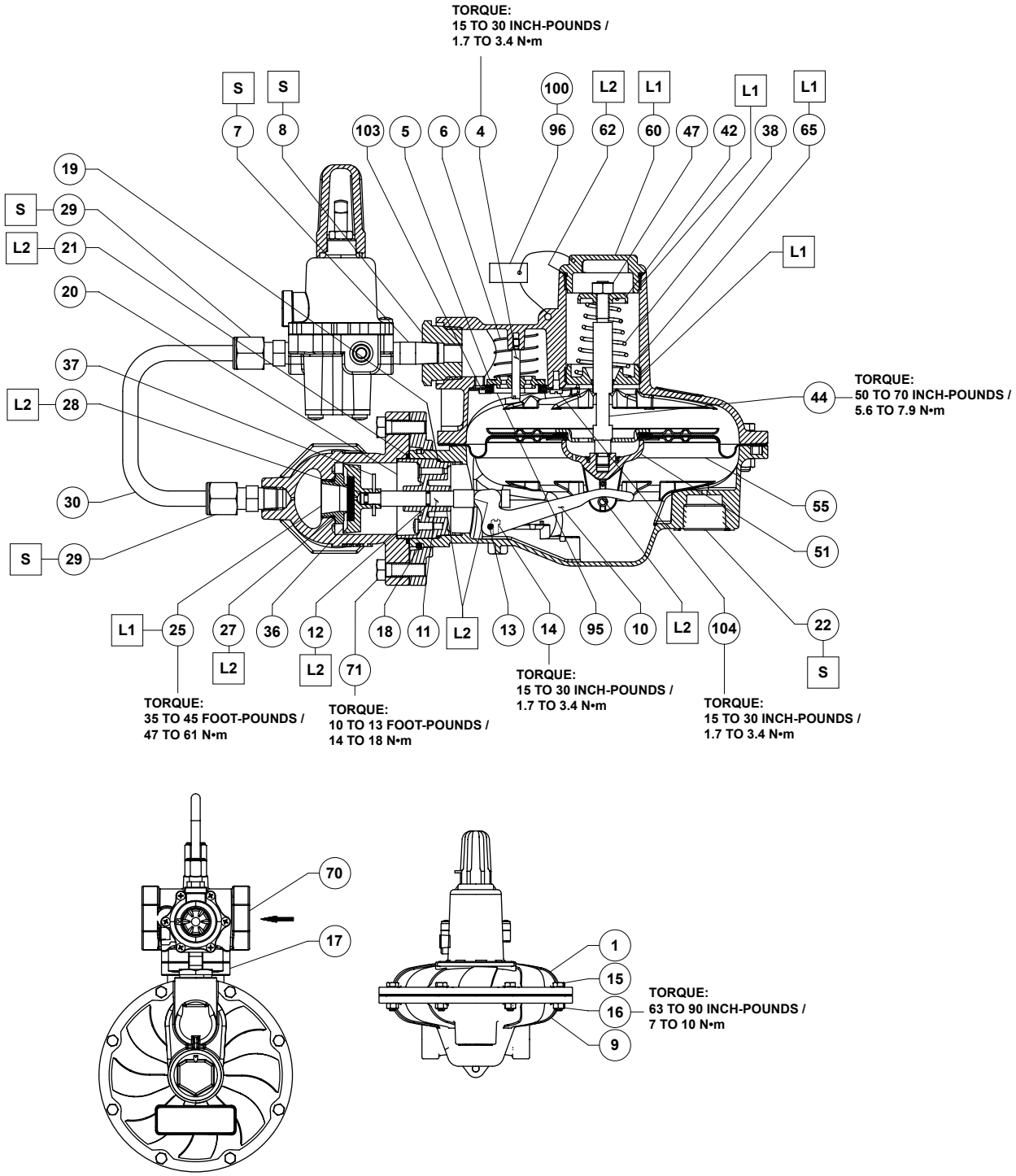
When ordering replacement parts, reference the key number of each needed part as found in the following parts list. Separate kit containing all recommended spare parts is available.

Parts List

CP400 Series Pressure Loaded Regulator Main Valve and Actuator (See Figures 8 through 14)

Key	Description	Part Number
	Spare Parts (Repair Parts Kit includes keys 12, 19, 21, 27, 36, 55 and 62) Types CP400, CP403 and CP404	RCP400X0012
1	Upper Spring Case, Aluminum	GE24555X012
4	Stabilizer Guide, Stainless steel	GE27061X012
5	Stabilizer, Engineered Resin	GE46735X012
6	Stabilizer Spring, Stainless steel	GE35010X012
7	Pipe Nipple, Zinc-plated steel	1C488226232
8	Pipe Bushing, Zinc-plated steel	1H1714X0032
9	Lower Casing, Aluminum	GE24289X012
10	Lever, Steel	GE27194X012
11	Stem, Aluminum	GE27402X012
12*	O-ring, Nitrile (NBR)	1E472706992
13	Lever Pin, Stainless steel	T14397T0012
14	Lever Screw, Zinc-plated steel (2 required)	GE34243X012
15	Cap Screw, Steel (8 required)	GE32059X012
16	Nut, Steel (8 required)	GE32060X012
17	Union Ring, Aluminum	GE26590X012
18	Snap Ring, Stainless steel	T1120637022
19*	O-ring, Nitrile (NBR)	1K594906562
20	Stem Guide, Aluminum	GE25385X012
21*	O-ring, Nitrile (NBR)	GE45216X012
22*	Pipe Plug, 3/4 NPT, Carbon steel (for internal registration only)	GE34199X012
23	Screw, Steel	1E175828982
24*	O-ring, Nitrile (NBR)	17A0960X012

*Recommended spare part



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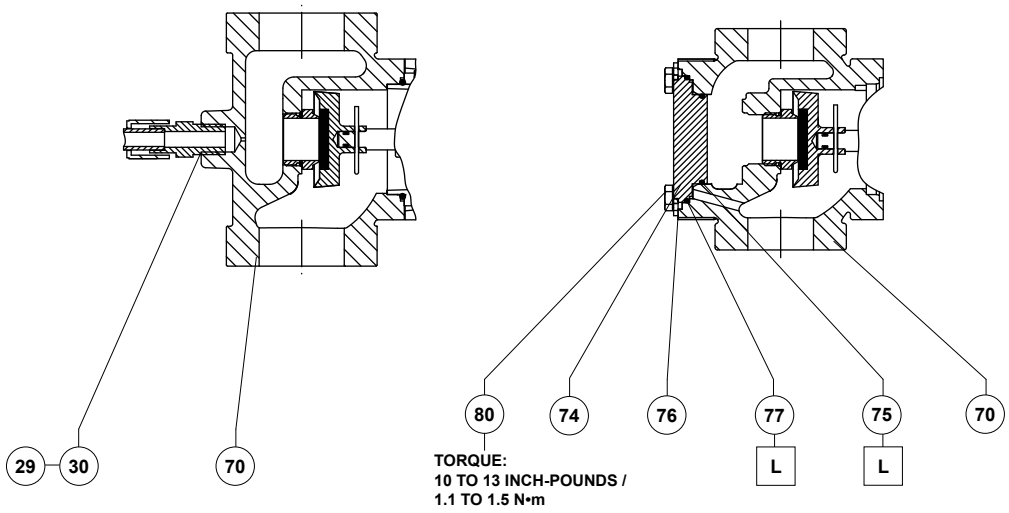
☐ **APPLY LUBRICANT (L) / SEALANT (S)[1]:**
L1 = ANTI-SEIZE LUBRICANT
L2 = SILICON GREASE
S = THREAD SEALANT

1. Lubricants/Sealant must be selected such that they meet the temperature requirements.

Figure 8. *CP400 Series Pressure Loaded Pressure Reducing Regulator Assemblies*



1. Lubricant must be selected such that they meet the temperature requirements.

Figure 9. *CP400 Series Body Assemblies*

Key	Description	Part Number
25*	Orifice, Aluminum	
	3/16-inch / 4.8 mm	T1122409012
	1/4-inch / 6.4 mm	T12522T0012
	3/8-inch / 9.5 mm	T1122309012
	1/2-inch / 13 mm	T1122009012
	5/8-inch / 16 mm	GE31234X012
	3/4-inch / 19 mm	T1121909012
26*	OPP Orifice	
	With Integral Monitor Orifice, 1-inch / 25 mm, Aluminum	GE30003X012
	With Slam-shut Orifice, 0.75-inch / 19 mm, Brass	GE28684X012
27*	O-ring, (1 required for Type CP400, 2 required for Types CP403 and CP404) Nitrile (NBR)	10A3802X022
28	O-ring, Nitrile (NBR)	GE01439X012
29	Connector (2 required for Type CP400, 1 required for Types CP403 and CP404)	
	Steel	----------
	Stainless steel **(standard)**	----------
	Stainless steel, Swagelok®	----------
30	Pilot Supply Tubing, Stainless steel	----------
31	Elbow	
	Steel	----------
	Stainless steel **(standard)**	----------
	Stainless steel, Swagelok®	----------
36*	Disk, Aluminum/Nitrile (NBR)	GE26497X012
37	Disk Clip, Stainless steel	GE33771X012
38	Closing Spring, Stainless steel	GE27211X012
42	Upper Spring Seat, Aluminum	GE27349X012
43	Diaphragm Retainer, Steel	GE27327X012
44	Closing Stem, Aluminum	GE27397X012
47	Nut, Steel	GE30042X012
51	Pusher Post, Aluminum	ERAA00877A0
53	Pusher Post Pin, Stainless steel	GE29761X012
54	Roller Pin, Brass	GE27060X012
55*	Diaphragm Assembly, Steel/Nitrile (NBR)	GE32574X012
55a	Diaphragm	----------
55b	Diaphragm Head	----------
55d	Diaphragm Pad	----------
56	Retaining Ring, Pusher Post Pin, Steel	GE33772X012
57	Slotted Spring Pin, Zinc-plated steel	GE33668X012
60	Closing Cap, Aluminum	GE29244X012
62*	O-ring, Nitrile (NBR)	T10275X0012
65	Adjusting Screw, Aluminum	GE27828X012
70	Globe Body	
	Gray Cast Iron	
	1-1/4 NPT	GE26446X012
	1-1/4 X 1-1/2 NPT	GE44458X012
	1-1/2 NPT	GE26448X012
	2 NPT	GE26459X012
	NPS 2 / DN 50, CL125 FF	GE26460X012
	Ductile Iron	
	1-1/4 NPT	GE26465X012
	1-1/2 NPT	GE26466X012
	2 NPT	GE26467X012
	Rp 1-1/4	GE26469X012
	Rp 1-1/2	GE26470X012
	Rp 2	GE26471X012
	NPS 2 / DN 50, CL125/CL150 FF	GE26480X012
	NPS 2 / DN 50, PN 10/16	GE26481X012
	Steel	
	1-1/4 NPT	GE26465X022
	1-1/2 NPT	GE26466X022
	Rp 1-1/4	GE26469X022
	Rp 1-1/2	GE26470X022
71	Bolts, Steel (2 required)	GE32061X012
74	Blanking Plug, Aluminum	GE31255X012

*Recommended spare part
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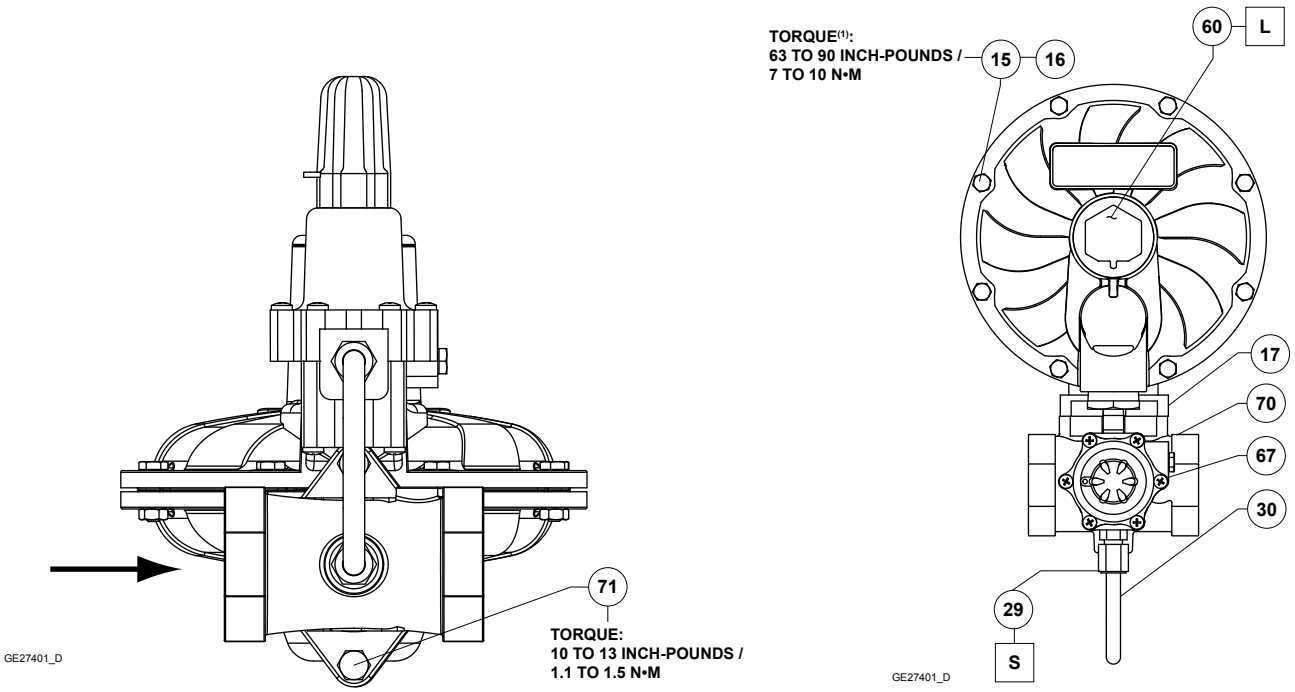
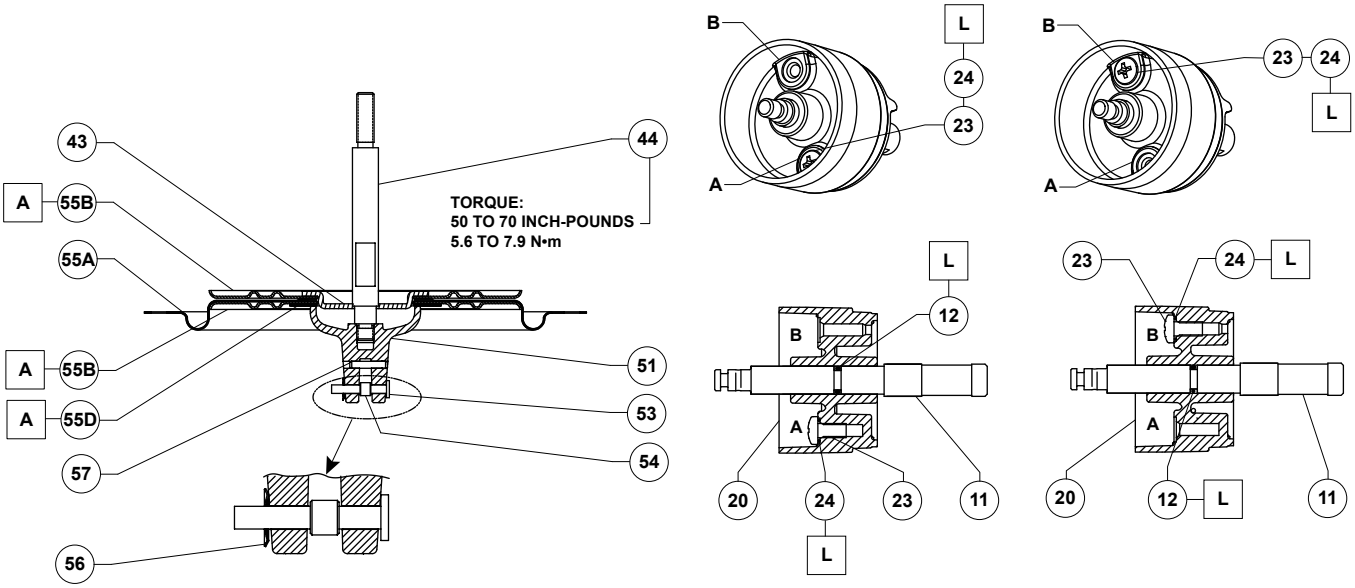


☐ **APPLY LUBRICANT (L) / SEALANT (S)(2):**
L = ANTI-SEIZE LUBRICANT
S = THREAD SEALANT

1. The torque range as specified is initial assembly torque. Due to elastomeric compression, the torque values indicated may decrease. Minimum inspection torque is 35 inch-pounds / 4.0 N•m.
2. Lubricant/Sealant must be selected such that they meet the temperature requirements.

Figure 10. *CP400 Series Pressure Loaded Pressure Reducing Regulator Assemblies*



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☐ **APPLY ADHESIVE (A)(1)**

1. Adhesive must be selected such that they meet the temperature requirements.

Figure 11. *CP400 Series Diaphragm and Stem Assembly*

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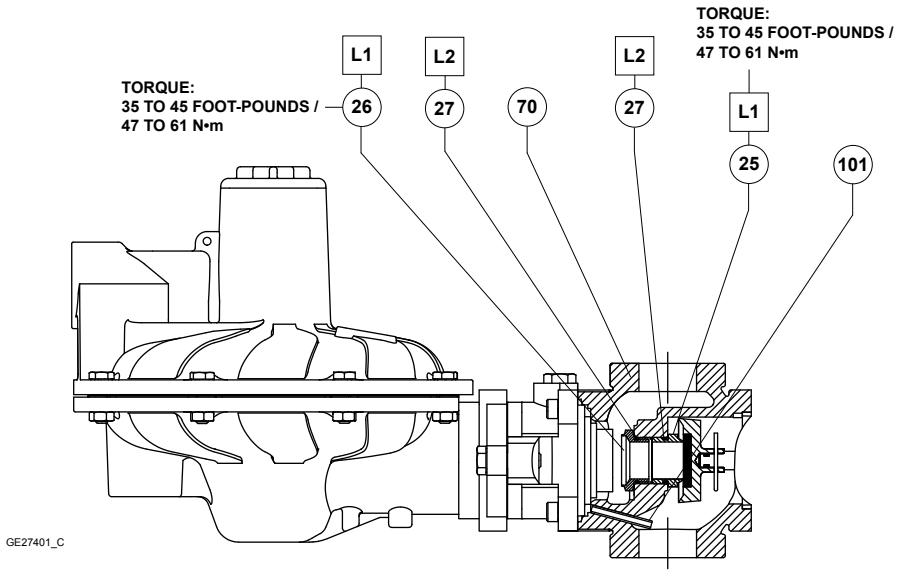
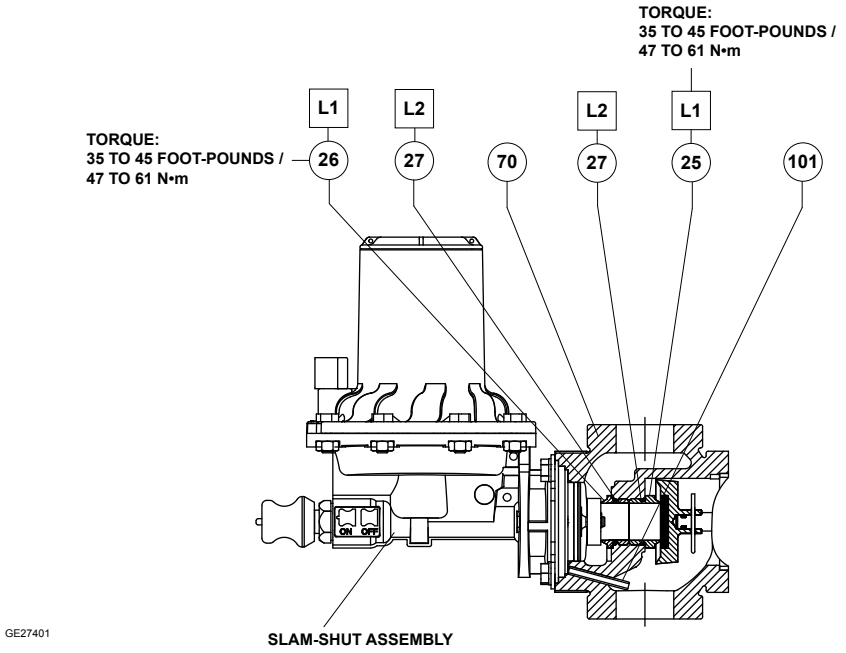
☐ **APPLY LUBRICANT (L)(1)**
L = SILICON GREASE

1. Lubricant must be selected such that they meet the temperature requirements.

Figure 12. *CP400 Series Registration Options*



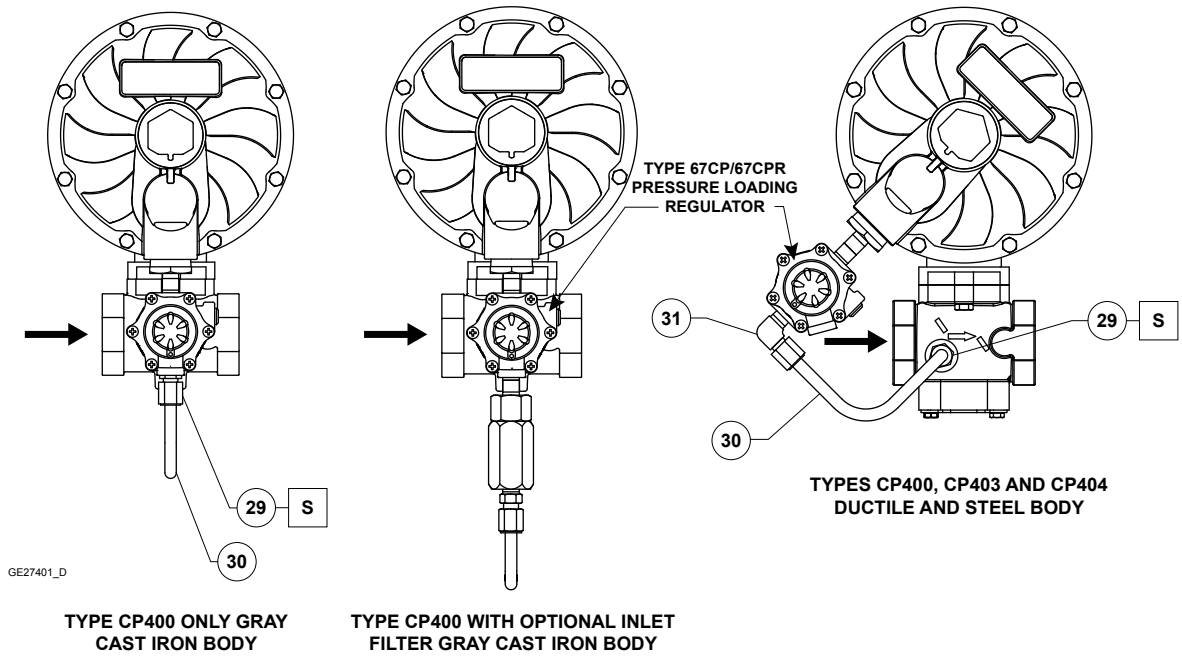
TRUE-MONITOR™ ASSEMBLY



☐ **APPLY LUBRICANT (L)[1]:**
L1 = ANTI-SEIZE LUBRICANT
L2 = SILICON GREASE

1. Lubricants must be selected such that they meet the temperature requirements.

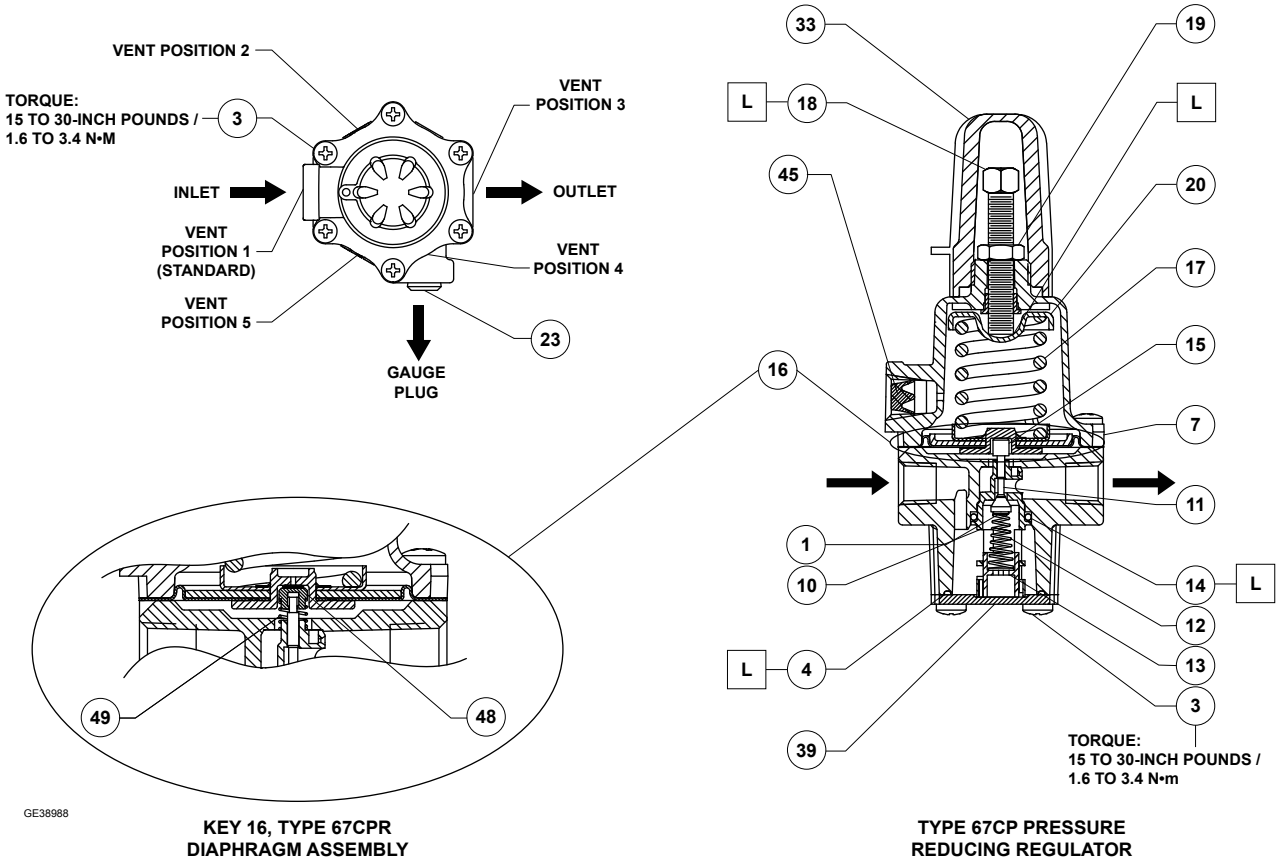
Figure 13. *CP400 Series Slam shut and Integral Monitor Modules*



☐ **APPLY SEALANT (S)[1]**
S = THREAD SEALANT

1. Sealant must be selected such that they meet the temperature requirements.

Figure 14. *Gray Cast Iron, Ductile Iron and Steel Body Configurations*



☐ **APPLY LUBRICANT (L)[1]**
L = MULTI-PURPOSE PTFE LUBRICANT

1. Lubricant must be selected such that they meet the temperature requirements.

Figure 15. *67CP Series Pressure Loading Regulator Assembly*

Key	Description	Part Number
75	O-ring, Nitrile (NBR)	GF03442X012
76	Flange Ring, Steel 2 required	GF01942X012
77	O-ring, Nitrile (NBR)	GF03443X012
80	Screw (4 required)	GE38176X012
90	Nameplate	- - - - - - - - - -
91	Warning Label	- - - - - - - - - -
93	Label	- - - - - - - - - -
94	Overlay Label	- - - - - - - - - -
95	Grommet, Nitrile (NBR)	GE35358X012
96	Caution Tag (when specified)	- - - - - - - - - -
100	Wire and Seal (when specified)	- - - - - - - - - -
101	Slotted Spring Pin, Carbon-plated steel	GE32724X012
102	Filter	See P590X1
103	Stabilizer Retainer, Steel	GE27024X012
104	Stabilizer Screw (3 required), Zinc-plated	GE29724X012

67CP Series Pressure Loading Regulator (See Figure 15)

Key	Description	Part Number
	Valve Cartridge Assembly For Type 67CP (without relief) only (includes keys 10, 11, 12, 13, 14 and 15)	T14121T0082
	For Type 67CPR (with relief) only (includes keys 10, 11, 12, 13 and 14)	T14121T0142
1	Body, Aluminum	T40643T0RG2
3	Flange Screw, Steel (10 required)	T13526T0012
4*	O-ring, Nitrile (NBR)	T14380T0012
7	Bonnet Assembly, Aluminum/Steel	T14070T0022
10	Cartridge, Polyester	T80434T0012
11	Valve Stem, Brass	
	Type 67CP	T14053T0012
	Type 67CPR	GE43501X012
12	Valve Spring, Stainless steel	GE27212X012
13	Valve Retainer, Engineered Resin	T14071T0012
14*	O-ring, Nitrile (NBR)	T14063T0012
15	Soft Seat, Nitrile (NBR) (Type 67CP only)	T14055T0012
16*	Diaphragm Assembly	
	Type 67CP	
	Nitrile (NBR)/Steel	T14119T0022
	Fluorocarbon (FKM)/Steel	T14119T0042
	Type 67CPR, Nitrile (NBR)/Aluminum	GE40272X012
17	Spring, Stainless steel	
	1 to 2 psig / 69 mbar to 0.14 bar, Yellow Stripe	GE30199X012
	2 to 5 psig / 0.14 to 0.34 bar, Orange Stripe	GE27213X012
	5 to 10 psig / 0.34 to 0.69 bar, Black Stripe	GE39890X012
	10 to 20 psig / 0.69 to 1.4 bar, Purple Stripe	GE30200X012
18	Adjusting Screw, Steel	T14101T0012
19	Locknut, Steel	1A946324122
20	Upper Spring Seat, Steel	T14051T0012
23	1/4 NPT Pipe Plug, Alloy-plated steel	1C333528992
33	Closing Cap, Plastic	23B9152X012
39	Bottom Plate, Stainless steel (NACE)	GE03520XRG2
45	Screen, Stainless steel	0L078343062
48	Relief Valve Plug (Type 67CPR only), Brass	GE43500X012
49	Relief Valve Spring (Type 67CPR only), Stainless steel	GE40051X012

*Recommended spare part

Industrial Regulators

Emerson Process Management
Regulator Technologies, Inc.

USA - Headquarters
McKinney, Texas 75070 USA
Tel: +1 800 558 5853
Outside U.S. +1 972 548 3574

Asia-Pacific
Shanghai 201206, China
Tel: +86 21 2892 9000

Europe
Bologna 40013, Italy
Tel: +39 051 419 0611

Middle East and Africa
Dubai, United Arab Emirates
Tel: +011 971 4811 8100

Natural Gas Technologies

Emerson Process Management
Regulator Technologies, Inc.

USA - Headquarters
McKinney, Texas 75070 USA
Tel: +1 800 558 5853
Outside U.S. +1 972 548 3574

Asia-Pacific
Singapore 128461, Singapore
Tel: +65 6770 8337

Europe
Bologna 40013, Italy
Tel: +39 051 419 0611
Chartres 28008, France
Tel: +33 2 37 33 47 00

Middle East and Africa
Dubai, United Arab Emirates
Tel: +011 971 4811 8100

TESCOM

Emerson Process Management
Tescom Corporation

USA - Headquarters
Elk River, Minnesota 55330-2445, USA
Tels: +1 763 241 3238
+1 800 447 1250

Europe
Selmsdorf 23923, Germany
Tel: +49 38823 31 287

Asia-Pacific
Shanghai 201206, China
Tel: +86 21 2892 9499

For further information visit www.emersonprocess.com/regulators

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